REMARKS

Claims 2, 5, 7 through 9, 13 and 15 of the substitute specification are canceled without prejudice while Claims 1, 3, 4, 6, 10 through 12 and 14 are amended to conform to like changes made to the claims of International application PCT/EP2004/013447 under Article 19 PCT on May 4, 2005 in response to the PCT Written Opinion dated March 4, 2005. Changes made to the substitute specification herein correspond to those filed in a response dated October 24, 2005 to the Written Opinion.

No new matter is added by the changes made herein.

Respectfully submitted,

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Title: METHOD FOR QUADRATURE-BIAS COMPENSATION IN
           A CORIOLIS GYRO, AS WELL AS A CORIOLIS GYRO
           WHICH IS SUITABLE FOR THIS PURPOSE

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BACKGROUND

Field of the Invention:

The present invention relates to Coriolis gyroscopes. More particularly, the invention pertains to a method for quadrature-bias compensation in a Coriolis gyro, and to a Coriolis gyro which is suitable for such this purpose.

Description of the Prior Art

Coriolis gyros (also referred to as "vibration gyros") are being increasingly employed used for navigation. purposes; they have Such devices include a mass system that which is caused to oscillate. The Each mass system generally has a large number of oscillation modes, which are initially independent of one another. In order A specific oscillation mode of the mass system is artificially excited to operate the Coriolis gyro. and this Such mode is referred to in the following text as the "excitation oscillation".

Coriolis forces occur that which draw energy from the excitation oscillation of the mass system When the Coriolis gyro is rotated and thus transmit a

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further oscillation mode of the mass system ~~which is~~ (referred to <u>below</u> ~~in the following text~~ as the "read oscillation"). ~~In order~~ The read oscillation is tapped off to determine rotations of the Coriolis gyro and a corresponding read signal is investigated to determine whether any changes have occurred in the amplitude of the read oscillation which represent a measure of ~~the~~ rotation of the Coriolis gyro.

Coriolis gyros may <u>comprise either</u> ~~be in the form of both~~ an open-loop <u>or</u> ~~system and~~ a closed-loop system. In a closed-loop system, the amplitude of the read oscillation is continuously reset to a fixed value <u>(preferably zero)</u> via respective control loops, and the resetting forces ~~are~~ measured.

The mass system of the Coriolis gyro ~~which is also~~ (referred to <u>below</u> ~~in the following text~~ as the "resonator") may ~~in this case~~ be <u>of</u> ~~designed in~~ widely differing <u>designs.</u> ~~ways.~~ For example, it is possible to use an integral mass system. Alternatively, it is possible to split the mass system into <u>separate</u> ~~two~~ oscillators ~~which are~~ coupled to one another via a spring system and <u>capable of</u> ~~can carry out relative~~ movements <u>relative</u> ~~with respect~~ to one another. For example, it is known <u>to use</u> ~~for~~ a coupled system comprising two linear oscillators ~~to be used, and this is~~ (also referred to as a <u>"linear double-oscillator"</u> system). ~~If~~ <u>When such</u> a coupled system ~~such as this~~ is

used, ~~then~~ alignment errors of the two oscillators with respect to one another are unavoidable <u>due to</u> ~~because of~~ manufacturing tolerances. The alignment errors ~~of the two oscillators with respect to one another~~ produce a zero error component in the measured rotation rate signal, the so-called "quadrature bias" (<u>more precisely,</u> ~~or to be more precise:~~ a quadrature-bias component).

SUMMARY AND OBJECTS OF THE INVENTION

<u>It is therefore an</u> ~~The~~ <u>of</u> ~~object on~~ which the invention ~~is based is~~ to <u>provide</u> ~~specify~~ a method and a Coriolis gyro <u>for compensating</u> ~~by means of which it is possible to compensate~~ for a quadrature-bias component <u>as described above.</u> ~~such as this.~~

<u>The present invention addresses the preceding and other objects by providing, in a first aspect, a method for quadrature-bias compensation in a Coriolis gyro whose resonator is in the form of a coupled system comprising a first and a second oscillator. Such method includes determination of the quadrature bias of the gyro and production of an electrostatic field to vary the mutual alignment of the two oscillators with respect to one another. The alignment/strength of the electrostatic field is regulated so that the determined quadrature bias is as small as possible.</u>

In a second aspect, the invention provides a Coriolis gyro in the form of a coupled system comprising a first and a second linear oscillator. Such gyro includes a device for production of an electrostatic field for varying the alignment of the two oscillators with respect to one another.

A device is provided for determination of any quadrature bias of the Coriolis gyro as well as a control loop for regulating the strength of the electrostatic field as a function of the determined quadrature bias so that the determined quadrature bias is as small as possible.

In a third aspect, the invention provides a Coriolis gyro having a first and a second resonator. The resonators are each in the form of a coupled system including a first and a second linear oscillator.

The first resonator is mechanically/electrostatically connected/coupled to the second resonator so that the two resonators can be caused to oscillate in antiphase with respect to one another along a common oscillation axis.

The foregoing and other features of the invention will become further apparent from the detailed description that follows. Such description is accompanied by a set of drawing figures. Numerals of

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the drawings, corresponding to those of the written description, point to the features of the invention with like numerals referring to like features throughout.

5 ~~According to the invention, this object is achieved by a method for quadrature-bias compensation for a resonator having two linear oscillators as claimed in patent claim 1. The invention also provides an embodiment of a Coriolis gyro which is suitable for~~
10 ~~this purpose, as claimed in patent claim 6. A further suitable embodiment of a Coriolis gyro is contained in patent claim 12. Advantageous refinements and developments of the idea of the invention can be found in the respective dependent claims.~~

15   BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic illustration of ~~shows~~ one possible embodiment of a mass system having ~~which comprises~~ two linear oscillators, with corresponding control loops, for exciting ~~which are used to excite~~
20 the first oscillator.

Figure 2 is a scematic illustration of a ~~shows one~~ possible embodiment of a mass system having ~~which comprises~~ two linear oscillators with corresponding measurement and control loops for a
25 rotation rate Ω and a quadrature bias B_Q, as well as auxiliary control loops for compensation of the

quadrature bias B_Q.

Figure 3 <u>is a schematic illustration</u> ~~shows an outline sketch~~ of a mass system <u>in accordance with an embodiment of</u> ~~according to~~ the invention, which comprises four linear oscillators, with corresponding measurement and control loops for a rotation rate Ω and a quadrature bias B_Q, as well as ~~the~~ auxiliary control loops for compensation of the quadrature bias.

Figure 4 <u>is a block diagram of an embodiment of a</u> ~~shows one preferred embodiment of the~~ control system <u>for incorporation into a mass system in accordance with that illustrated in Figure 3 above.</u> ~~shown in Figure 3.~~

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The method <u>of</u> ~~according to~~ the invention for quadrature-bias compensation can be applied, in particular, to Coriolis gyros whose resonators are in the form of coupled systems comprising at least one first and one second linear oscillator. ~~and has the following steps: determination of the quadrature bias of the oscillator system, production of an electrostatic field in order to vary the mutual alignment of the two oscillators with respect to one another, with the alignment/strength of the electrostatic field being regulated such that the determined quadrature bias is as small as possible.~~

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The total quadrature bias of the oscillator system is preferably determined ~~in this case. This is preferably done~~ by demodulation of a read signal ~~which is~~ produced by ~~means of~~ read electrodes, with 0° and appropriate resetting. ~~Alternatively,~~ It is _also_ possible to ~~deliberately~~ determine only a portion of the quadrature bias, ~~which is~~ produced by the alignment error of the two linear oscillators with respect to one another. (The expression "quadrature bias" covers both alternatives.)

~~The~~ Quadrature bias is thus eliminated at its point of origin ~~itself, that is to say~~ _i.e.,_ mechanical alignment errors of the two oscillators with respect to one another are compensated ~~for~~ by ~~means of~~ an electrostatic force _that_ ~~which~~ acts on one or both oscillators and is produced by the electrostatic field.

In one ~~preferred~~ embodiment, the Coriolis gyro has first and second spring elements, with the first oscillator ~~being~~ connected by means of the first spring elements to a ~~gyro~~ frame of the Coriolis gyro and the second oscillator ~~being~~ connected by ~~means of~~ the second spring elements to the first oscillator. The electrostatic field ~~in this case~~ results in a change in the alignment of the first ~~spring elements~~ and/or ~~a change in the alignment of~~ the second spring elements. The alignment of the second spring elements is preferably varied by varying the position/alignment of

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the second oscillator <u>with</u> ~~by means of~~ the
electrostatic field. Analogously ~~to this~~, the alignment
of the first spring elements is preferably varied by
varying the position/alignment of the first oscillator
by means of the electrostatic field. The change in the
positions/alignments of the oscillators in <u>such</u> ~~this~~
case results in bending ~~of~~ the spring elements ~~which
are~~ attached to the oscillators, ~~thus~~ making it
possible to correct corresponding alignment angles of
the first spring elements with respect to the second
spring elements.

In <u>a</u> ~~one~~ particularly preferred embodiment,
the electrical field <u>varies</u> ~~is used to vary~~ the
alignment angles of the first and second spring
elements <u>so</u> ~~such~~ that <u>they</u> ~~the alignments of the first
and second spring elements~~ are made orthogonal with
respect to one another. ~~Once they have been made
orthogonal in this way,~~ This compensates for the
quadrature-bias (component) ~~that is~~ produced ~~in this
way~~. If there are any further contributions to ~~the~~
quadrature bias, the angle error with respect to
orthogonality is adjusted <u>so</u> ~~such~~ that the total
quadrature bias disappears. The alignment angles of the
second spring elements with respect to the first
oscillator are preferably varied by ~~means of~~ the
electrostatic field and the alignment angles of the
first spring elements with respect to the gyro frame of
the Coriolis gyro are <u>unchanged.</u> ~~not changed. However,~~

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It is ~~also~~ possible to use the electrostatic field to
vary only the alignment angles of the first spring
elements, or to vary the alignment angles of both the
first and the second spring elements.

5   The ~~method according to the~~ invention also
~~furthermore~~ provides a Coriolis gyro whose resonator is
in the form of a coupled system comprising at least one
first and one second linear oscillator. ~~and which has~~
It includes ~~has~~ a device for production of an

10 electrostatic field ~~by means of which~~ to vary the
alignment of the two oscillators with respect to one
another ~~can be varied,~~ as well as a device for
~~determination of any~~ determining quadrature bias ~~which~~
~~is~~ caused by alignment errors of the two oscillators

15 with respect to one another and with other ~~further~~
coupling mechanisms. ~~and~~ A control loop regulates ~~with~~
~~the control loop regulating~~ the strength of the
electrostatic field as a function of the determined
quadrature bias so ~~such~~ that the ~~determined~~ quadrature

20 bias is as small as possible.

    If the resonator comprises a first and a
second linear oscillator, then the Coriolis gyro
preferably has first and second spring elements. ~~with~~

25 The first spring elements connect ~~connecting~~ the first
oscillator to the ~~gyro~~ frame of the Coriolis gyro, and
the second spring elements connect ~~connecting~~ the
second oscillator to the first oscillator. The

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alignments of the first and second spring elements are ~~in this case~~ preferably at right angles to one another and ~~The spring elements~~ may ~~in this case~~ be of any desired form.

5   It has been found to be advantageous for the second oscillator to be attached to or clamped in on the first oscillator "at one end". "Clamped in at one end" can ~~in this case~~ be understood not only in the sense of the literal wording but also in a general

10   sense. In general, attached or clamped in "at one end" means that the force is introduced from the first oscillator to the second oscillator essentially from one "side" of the first oscillator. If, <u>for</u> ~~by way of~~ example, the oscillator system were ~~to be~~ designed <u>so</u>

15   ~~in such a way~~ that the second oscillator <u>were</u> ~~is~~ bordered by the first oscillator and ~~is~~ connected to it by means of second spring elements, then the expression "clamped in or attached at one end" would imply <u>that</u> ~~the following:~~ the second oscillator is readjusted for

20   ~~the~~ movement of the first oscillator, with the first oscillator alternately "pushing" or "pulling" the second oscillator by means of the second spring elements.

       Clamping the second oscillator in at one end on

25   the first oscillator has the advantage that, when an electrostatic force is exerted on the second oscillator as a result of the alignment/position change of the

second oscillator ~~which results from this,~~ the second
spring elements can be slightly curved, thus making it
possible, without any problems, to vary the
corresponding alignment angle of the second spring
elements. If the second oscillator ~~in this example~~ were
to be attached to additional second spring elements <u>so</u>
~~in such a way~~ that, during movement of the first
oscillator, the second oscillator were at the same time
to be "pulled" and "pushed" by the second spring
elements, then this would be equivalent to the second
oscillator being clamped in or attached "at two ends"
to the first oscillator (with the force being
introduced to the second oscillator from two opposite
ends of the first oscillator). In <u>such</u> ~~this~~ case, the
additional second spring elements would produce
corresponding opposing forces when an electrostatic
field is applied, so that changes in the alignment
angles of the second spring elements could be achieved
only with difficulty. However, clamping in at two ends
is acceptable when the additional second spring
elements are designed <u>so</u> ~~such~~ that the influence of
these spring elements is small so that all of the
spring elements can bend without any problems. ~~in this~~
~~case as well,~~ That is, ~~to say~~ the clamping in is
effectively at one end.

Depending on the design of the oscillator,
~~structure~~ clamping in at one end can be effectively
provided just by the "influence" (force introduction)

of the additional second spring elements being 40% or
less. However, this value does not present any
limitation on ~~restriction to~~ the invention. ~~and~~ It is
also feasible for the influence of the second spring
elements to be more than 40%. ~~By way of~~ For example,
clamping in at one end can be achieved by all of the
second spring elements that ~~which~~ connect the second
oscillator to the first oscillator being arranged
parallel and on the same plane. ~~as one another~~ All
start and end points of the second spring elements are
in each case attached to the same ends of the first and
second oscillator. The start and end points of the
second spring elements may ~~in this case~~ each
advantageously be on a common axis, with the axes
intersecting the second spring elements at right
angles.

If the second oscillator is attached to or
clamped on the first oscillator at one end, then the
first spring elements are preferably designed to ~~such~~
~~that they~~ clamp the first oscillator in on the gyro
frame at two ends (the expressions "at one end" and "at
two ends" can be used analogously ~~here~~). As an
alternative, ~~to this~~ however, it is possible for the
spring elements also to be designed to ~~in such a way~~
~~that they~~ clamp in the first oscillator at one end. ~~By~~
~~way of~~ For example, all the first spring elements that
~~which~~ connect the first oscillator to the gyro frame of
the Coriolis gyro can be arranged parallel and on the

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same plane as one another, with the start and end

points of the first spring elements in each case

preferably being located on a common axis. It is

equally possible for the spring elements to be designed

5   <u>so</u> ~~in such a way~~ that the first oscillator is clamped

in on the gyro frame at one end, and the second

oscillator is clamped in at two ends by the first

oscillator. It is also possible for both oscillators to

be clamped in at two ends. For quadrature bias

10   compensation, it has been found to be advantageous for

at least one of the two oscillators to be clamped in at

one end.

A further ~~advantageous~~ embodiment of a

Coriolis gyro ~~according to the invention~~ has a first

15   and a second resonator, ~~which are~~ each in the form of a

coupled system comprising a first and a second linear

oscillator. ~~with~~ The first resonator <u>is</u> ~~being~~

mechanically/electrostatically connected/coupled to the

second resonator <u>so</u> ~~such~~ that <u>they</u> ~~the two resonators~~

20   can be caused to oscillate in antiphase with respect to

one another along a common oscillation axis.

<u>Such</u> ~~This~~ embodiment <u>includes</u> ~~accordingly~~

~~has~~ a mass system <u>that</u> ~~which~~ comprises two double-

oscillator systems (<u>i.e.,</u> ~~that is to say~~ two

25   resonators) or four linear oscillators. ~~The~~ Antiphase

oscillation of the two resonators with respect to one

another ~~in this case~~ results in the center of gravity

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of the mass system remaining unchanged (provided that the two resonators are appropriately designed). ~~This means that the~~ As a result, oscillation of the mass system cannot produce any external vibration that ~~which~~ would, in turn, result in disturbances in the form of damping/reflections. Furthermore, external vibrations and accelerations in the direction of the common oscillation axis have no influence on ~~the~~ antiphase movement of the two resonators along the common oscillation axis.

~~By way of~~ For example, the first resonator can be coupled to the second resonator via a spring system. ~~which connects the first resonator to the second resonator~~ A further option is for the first resonator to be coupled to the second resonator via an electrostatic field. Both couplings can be used alone ~~on their own~~ or in combination ~~conjunction~~. It is sufficient for the two resonators to be formed in a common substrate, so that the mechanical coupling is provided by a mechanical spring connection ~~which is~~ formed by the common substrate itself.

In this embodiment ~~as well~~, the Coriolis gyro advantageously has a device for the production of electrostatic fields to vary ~~, by means of which~~ the alignment of the linear oscillators with respect to one another ~~can be varied~~, a device for determination of the quadrature bias of the Coriolis gyro, and control loops

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for regulating ~~by means of which~~ the strengths of the electrostatic fields <u>so</u> ~~are regulated such~~ that the determined quadrature bias is as small as possible.

The configurations of the first and ~~of the~~ second <u>resonators</u> ~~resonator~~ are preferably identical. In this case, <u>they</u> ~~the two resonators~~ are advantageously arranged axially symmetrically with respect to one another <u>and</u> ~~with respect~~ to an axis of symmetry ~~which is~~ at right angles to the common oscillator axis <u>(i.e.</u> ~~,~~ ~~that is to say~~ the first resonator is mapped by the axis of symmetry onto the second resonator<u>)</u>.

~~The invention will be explained in more detail in the following text, using an exemplary embodiment, and with reference to the accompanying figures, in which:~~

In order to assist understanding of the ~~technical~~ background of the method <u>of</u> ~~according to~~ the invention, the physical principles of a Coriolis gyro will be explained briefly <u>below</u> ~~once again in the following description,~~ with reference to ~~the example of~~ a linear double-oscillator system.

The Coriolis force can be represented as:

$$\vec{F} = 2m\vec{v}_s x\vec{\Omega}$$

$\vec{F}$ *Coriolis force*
m *Mass of the oscillator*   [1]
$\vec{v}_s$ *Velocity of the oscillator*
$\vec{\Omega}$ *Rotation rate*

If the mass that ~~which~~ reacts to the Coriolis
force is equal to the oscillating mass, and ~~if~~ the
oscillator is operated at the natural frequency ω, then:

5

$$2m\vec{v}_s x\vec{\Omega} = m\vec{a}_c \qquad\qquad [2]$$

The oscillator velocity is given by:

$$\vec{v}_s = \vec{v}_{s0} \sin \omega t \qquad\qquad [3]$$

where

$\vec{v}_{s0}$ = oscillator amplitude

10   ω = natural frequency of the oscillator

The oscillator and Coriolis accelerations are
thus given by:

$$\vec{a}_s = \vec{v}_{s0}\omega\cos\omega t$$
$$\vec{a}_c = 2\vec{v}_{s0}\sin\omega t \times \vec{\Omega} \qquad\qquad [4]$$

The two acceleration vectors are thus
15   spatially at right angles to one another and are offset
through 90° with respect to one another in the time
function (spatial and time orthogonality).

These two criteria can be employed ~~used in~~
~~order~~ to separate ~~the~~ oscillator acceleration $\vec{a}_s$ from

the Coriolis acceleration $\vec{a}_c$. The ratio of the abovementioned acceleration amplitudes a_c and a_s is:

$$\frac{a_c}{a_s} = \frac{2\Omega}{\omega} \qquad\qquad [5]$$

If the rotation rate is $\Omega = 5°/h$ and the natural frequency of the oscillator is $f_s = 10$ KHz, then:

$$\frac{a_c}{a_s} = 7.7 \cdot 10^{-10} \qquad\qquad [6]$$

For an accuracy of 5°/h, undesirable couplings of the first oscillator to the second oscillator must not exceed 7.7 • 10^{-10}, or must be constant. ~~at this value~~ If a mass system composed of two linear oscillators ~~is used, which are~~ coupled to one another via spring elements <u>is employed,</u> then the accuracy of the spatial orthogonality between the oscillation mode and the measurement mode is limited <u>due to</u> ~~because of~~ the alignment error of the spring elements. ~~The~~ Achievable accuracy (limited by manufacturing tolerances) is 10^{-3} to 10^{-4}. ~~The accuracy of the~~ Time orthogonality <u>accuracy</u> is limited by the phase accuracy of the electronics at, for example, 10 KHz, which can likewise be complied with only to at most 10^{-3} to 10^{-4}. This means that the ratio of the accelerations as defined above cannot be satisfied.

Realistically, the resultant error in the

measured acceleration ratio a_c/a_s is:

$$\frac{a_c}{a_s} = 10^{-6} to 10^{-8} \qquad\qquad [7]$$

The spatial error results in a so-called quadrature bias B_Q, which, together with the time phase error Δ_ϕ, results in a bias B:

$B_Q = 6.5 \cdot 10^6 \ °/h$ to $6.5 \cdot 10^5 \ °/h$

$\Delta_\phi = 10^{-3}$ to 10^{-4}

$B = B_Q \cdot \Delta_\phi = 6,500 \ °/h$ to $65 \ °/h$ $\qquad\qquad [8]$

The quadrature bias thus results in a major limitation ~~restriction~~ to ~~the~~ measurement accuracy. In this case, it should be noted that the preceding ~~above~~ error analysis takes account only of the direct coupling of the oscillation mode to the read mode. Further quadrature bias components also exist and occur, for example, as a result of couplings with other oscillation modes.

Figure 1 illustrates ~~shows~~ the schematic design of a linear double oscillator 1 with corresponding electrodes including ~~as well as~~ a block diagram of associated evaluation/excitation electronics 2. The linear double oscillator 1 is preferably produced by ~~means of~~ etching ~~processes from~~ a silicon wafer. ~~and~~ It has a first linear oscillator 3, a second linear oscillator 4, first spring elements 5_1 to 5_4, second spring elements 6_1 and 6_2 as well as parts of an

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intermediate frame 7_1 and 7_2 and ~~of~~ a gyro frame 7_3 and 7_4. The second oscillator 4 is mounted within the first oscillator 3 <u>to</u> ~~such that it can~~ oscillate, and is connected to it via the second spring elements 6_1, 6_2. The first oscillator 3 is connected to the gyro frame 7_3, 7_4 by ~~means of~~ the first spring elements 5_1 to 5_4 and the intermediate frame 7_1, 7_2.

~~Furthermore,~~ First excitation electrodes 8_1 to 8_4, first read electrodes 9_1 to 9_4, second excitation electrodes 10_1 to 10_4, and second read electrodes 11_1 and 11_2 are <u>also</u> provided. All of the electrodes are mechanically connected to the gyro frame, <u>although</u> ~~but are~~ electrically isolated. <u>(</u>The expression "gyro frame" <u>refers to</u> ~~means~~ a mechanical, non-oscillating structure in which the oscillators are "embedded", <u>e.g.,</u> ~~for example~~ the non-oscillating part of the silicon wafer<u>)</u>.

<u>When</u> ~~If~~ the first oscillator 3 is excited by ~~means of~~ the first excitation electrodes 8_1 to 8_4 to oscillate in the X1 direction, <u>such</u> ~~then this~~ movement is transmitted through the second spring elements 6_1, 6_2 to the second oscillator 4 (alternate "pulling" and "pushing"). The vertical alignment of the first spring elements 5_1 to 5_4 prevents the first oscillator 3 from moving in the X2 direction. However, ~~a~~ vertical oscillation can be carried out by the second oscillator 4 as a result of the horizontal alignment of the second spring elements 6_1, 6_2. When corresponding Coriolis

forces ~~accordingly~~ occur, then the second oscillator 4 is excited to oscillate in the X2 direction.

A read signal _that_ ~~which~~ is read from the first read electrodes 9_1 to 9_4 and ~~is~~ proportional to the amplitude/frequency of the X1 movement of the first oscillator 3 is supplied, via appropriate amplifier elements 21, 22 and 23, to an analog/digital converter 24. An appropriately digitized output signal from the analog/digital converter 24 is demodulated ~~not only~~ by a first demodulator 25 _and_ ~~but also~~ by a second demodulator 26 to form corresponding output signals, with the two demodulators operating with an offset of 90° with respect to one another. The output signal from the first demodulator 25 whose output signal controls a frequency generator 30 _so_ ~~such~~ that the signal _occurring_ ~~which occurs~~ downstream from the demodulator 25 is regulated at zero is supplied to a first regulator 27 ~~in order~~ to regulate the frequency of the excitation oscillation (the oscillation of the mass system 1 in the X1 direction). Analogously ~~to this,~~ the output signal from the second demodulator 26 is regulated at a constant value ~~which is~~ _(_predetermined by the electronics component 29_)_. A second regulator 31 _insures_ ~~ensures~~ that the amplitude of the excitation oscillation is regulated. The output signals from the frequency generator 30 and ~~from~~ the amplitude regulator 31 are multiplied by one another _at_ ~~by means of~~ a multiplier 32. An output signal from the multiplier 32, which is

proportional to the force to be applied to the first

excitation electrodes 8_1 to 8_4, acts not only on a first

force/voltage converter 33 but also on a second

force/voltage converter 34, which use the digital force

5   signal to produce digital voltage signals. The digital

output signals from the force/voltage converters 33, 34

are converted by ~~via a~~ first and ~~a~~ second digital/analog

converters ~~converter~~ 35, 36 to corresponding analog

voltage signals. ~~which are~~ Such signals are then passed

10   to the first excitation electrodes 8_1 to 8_4. The first

~~regulator 27~~ and ~~the~~ second regulators ~~regulator~~ 27, 31

readjust the natural frequency of the first oscillator 3

and set the amplitude of the excitation oscillation to a

specific, predeterminable value.

15   When Coriolis forces occur, resultant ~~the~~

movement of the second oscillator 4 in the X2 direction

(read oscillation) ~~that results from this~~ is detected by

the second read electrodes 11_1, 11_2, and a read signal,

~~which is~~ proportional to the movement of the read

20   oscillation, is supplied via appropriate amplifier

elements 40, 41 and 42 to an analog/digital converter 43

(see Figure 2). A digital output signal from the

analog/digital converter 43 is demodulated by a third

demodulator 44 in phase with the direct-bias signal and

25   ~~is~~ demodulated by a fourth demodulator 45, offset

through 90°. A corresponding output signal from the

first demodulator 44 is applied to a third regulator 46,

whose output signal is a compensation signal that ~~and~~

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corresponds to the rotation rate Ω to be measured. An output signal from the fourth demodulator 45 is applied to a fourth regulator 47 whose output signal is a compensation signal ~~and is~~ proportional to the quadrature bias to be compensated. ~~for~~ The output signal from the third regulator is modulated by ~~means of~~ a first modulator 48, and the output signal from the fourth regulator 47 is modulated in an analogous manner ~~to this~~ by ~~means of~~ a second modulator 49, so that amplitude-regulated signals are produced whose frequencies correspond to the natural frequency of the oscillation in the X1 direction ($\sin \simeq 0°$, $\cos \simeq 90°$). Corresponding output signals from the modulators 48, 49 are added in an addition stage 50, whose output signal is supplied both to a third force/voltage converter 51 and to a fourth force/voltage converter 52. The corresponding output signals for the force/voltage converters 51, 52 are supplied to digital/analog converters 53, 54, whose analog output signals are applied to the second excitation electrodes 10_2 to 10_3, and reset the oscillation amplitudes of the second oscillator 4.

The electrostatic field ~~which is~~ produced by the second excitation electrodes 10_1 and 10_4 (or the two electrostatic fields ~~which are~~ produced by the electrode pairs 10_1, 10_3 and 10_2, 10_4) results in an alignment/position change of the second oscillator 4 in the X2 direction, and thus in a change in the alignments

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of the second spring elements 6_1 to 6_2. The fourth
regulator 47 regulates the signal ~~which is~~ applied to
the second excitation electrodes 10_1 and 10_4 <u>so</u> ~~in such a
way~~ that the quadrature bias ~~which is~~ included in the
compensation signal of the fourth regulator 47 is as
small as possible, or disappears. A fifth regulator 55,
a fifth and a sixth force/voltage converter 56, 57 and
two analog/digital converters 58, 59 are used for this
purpose.

The output signal from the fourth regulator
47, which is a measure of the quadrature bias, is
supplied to the fifth regulator 55, <u>that</u> ~~which~~ regulates
the electrostatic field ~~that is~~ produced by the two
excitation electrodes 10_1 and 10_4 <u>so that</u> ~~in such a way
that~~ the quadrature bias B_0 disappears. ~~For this
purpose,~~ An output signal from the fifth regulator 55 is
~~in each case~~ supplied to the fifth and sixth
force/voltage converters 56, 57, <u>employing</u> ~~which use~~ the
digital for~~ce~~/output signal from the fifth regulator <u>55</u>
to produce digital voltage signals <u>that</u> ~~These~~ are then
converted to analog voltage signals in the
analog/digital converters 58, 59. The analog output
signal from the analog/digital converter 58 is supplied
to the second excitation electrode 10_1 ~~or~~ <u>(alternatively
to electrode</u> 11_1<u>)</u>. The analog output signal from the
analog/digital converter 59 is supplied to the second
excitation electrode 10_4 ~~or~~ <u>(alternatively</u> <u>to electrode</u>
11_2<u>)</u>.

<u>As</u> ~~Since~~ the second oscillator 4 is clamped ~~in~~
only by the second spring elements 6_1 to 6_2 (~~clamping~~
<u>clamped</u> ~~in~~ at one end), <u>such</u> ~~the~~ alignment of <u>the</u> ~~these~~
spring elements can be varied without <u>problem</u> by the
electrostatic field ~~any problems~~. It is <u>additionally</u>
~~also~~ possible to provide additional second spring
elements, ~~which result~~ <u>resulting</u> in the second
oscillator 4 being clamped ~~in~~ at two ends, provided that
<u>such</u> ~~these~~ additional ~~spring~~ elements are appropriately
designed to <u>insure</u> ~~ensure~~ that clamping ~~in~~ at one end is
<u>effective.</u> ~~effectively achieved.~~ In order to <u>permit</u>
~~allow~~ the same effect for the spring elements 5_1, 5_2 <u>(and</u>
<u>for</u> the spring elements 5_3, 5_4 as well<u>)</u> the third and
fourth spring elements 5_3, 5_4, <u>as well as</u> ~~and~~ the first
and second spring elements 5_1, 5_2 may be omitted, ~~thus~~
resulting in the first oscillator 3 being clamped ~~in~~ at
one end (together with an appropriately modified
electrode configuration, ~~which is~~ not shown ~~here~~). In
<u>such</u> a situation ~~such as this,~~ the second oscillator 4
~~could~~ <u>may</u> also be attached to the first oscillator by
~~means of~~ further spring elements ~~in order~~ to achieve
clamping ~~in~~ at two ends.

The electrode arrangements ~~which are~~ shown
in Figures 1 and 2 may be varied. For example, the
electrodes ~~which are~~ identified by the reference numbers
8_1, 9_1, 9_2, 8_2 as well as 8_3, 9_3, 9_4, 8_4 in Figures 1 and 2
may alternatively ~~in each case~~ be combined to form one

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electrode. An electrode ~~which has been~~ combined in this way may be allocated a plurality of tasks by using ~~the use of~~ suitable carrier frequency methods (i.e., ~~that is to say~~ the electrode has a read, excitation and compensation functions ~~function at the same time~~). The electrodes ~~which are~~ identified by the reference numbers 11_1, 10_1, 10_3 as well as 11_2, 10_2 and 10_4 can also ~~alternatively~~ be combined to form ~~in each case~~ one electrode.

~~One further possible embodiment of the Coriolis gyro according to the invention and its method of operation will be described in more detail in the following description with reference to Figure 3.~~

A ~~One~~ preferred embodiment of the Coriolis gyro of ~~according to~~ the invention as well as ~~and~~ its method of operation will be described in more detail ~~in the following description~~ with reference to Figure 3, a schematic illustration of a mass system comprising four linear oscillators with corresponding measurement and control loops for rotation rate and quadrature mass, as well as auxiliary control loops for compensation of the quadrature bias. ~~Figure 3 shows~~ The schematic layout of coupled system 1' comprises ~~comprising~~ a first resonator 70_1 and a second resonator 70_2. The first resonator 70_1 is coupled to the second resonator 70_2 by ~~via~~ a mechanical coupling element (a spring) 71. The first and the second resonator 70_1, 70_2 are formed in a common

substrate and <u>may</u> ~~can~~ be caused to oscillate in
antiphase with respect to one another along a common
oscillation axis 72. The first and ~~the~~ second <u>resonators</u>
~~resonator~~ 70_1, 70_2 are identical, and are mapped onto one
another via an axis of symmetry 73. The design of the
first and ~~of the~~ second resonator 70_1, 70_2 has ~~already~~
been explained in conjunction with Figures 1 and 2 and
will therefore not be explained again. <u>(</u>Identical and
mutually corresponding components or component groups
are identified by the same reference numbers with
identical components ~~which are~~ associated with different
resonators being identified by different indices.<u>)</u>

<u>A</u> ~~One~~ major difference between the double
oscillators shown in Figure 3 and <u>those</u> ~~the double~~
~~oscillators~~ shown in Figures 1 and 2 is that some of the
individual electrodes are physically combined to form
one overall electrode. For example, the individual
electrodes ~~which are~~ identified by the reference numbers
8_1, 8_2, 9_1 and 9_2 in Figure 3 ~~thus~~ form a common
electrode. <u>Further,</u> ~~Furthermore,~~ the individual
electrodes ~~which are~~ identified by the reference numbers
8_3, 8_4, 9_3 and 9_4 form a common electrode, ~~and~~ those with
the reference numbers 10_4, 10_2, 11_2 as well as the
reference numbers 11_1, 10_3 and 10_1 each form an overall
electrode. The same applies in an analogous manner to
the other double-oscillator system.

During operation of the coupled system 1' <u>in</u>

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accordance <u>with</u> ~~according to~~ the invention, the two
resonators 70_1, 70_2 oscillate in antiphase along the
common oscillation axis 72. The coupled system 1' is
thus not susceptible to external disturbances or to
<u>those</u> ~~disturbances which are~~ emitted by the coupled
system 1' itself into the substrate in which the
resonators 70_1 and 70_2 are mounted.

When the coupled system 1' is rotated, ~~then~~
the second oscillators 4_1 and 4_2 are deflected in
mutually opposite directions (<u>i.e.,</u> ~~in~~ the X2 direction
and ~~in the~~ opposite ~~direction~~ to the X2 direction). When
an acceleration of the coupled system 1' occurs, ~~then~~
the second oscillators 4_1, 4_2 are each deflected in the
same direction, <u>i.e.,</u> ~~specifically~~ in the same direction
as the acceleration provided that <u>such</u> ~~this~~ acceleration
is in the X2 direction, or in the opposite direction. ~~to
it~~ Accelerations and rotations can thus be measured
simultaneously or selectively. Quadrature bias
compensation can be carried out ~~at the same time~~ during
the measurement process in the resonators 70_1, 70_2.
However, this is not absolutely essential.

In principle, it is possible to operate the
coupled system 1' on the basis of the
evaluation/excitation electronics 2 described <u>with</u>
<u>reference to</u> ~~in~~ Figures 1 and 2. ~~However,~~ An alternative
method (carrier frequency method) is ~~used~~ instead <u>used</u>
~~of this~~ in the embodiment <u>of</u> ~~shown in~~ Figure 3. <u>Such</u>

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~~This~~ operating method will be described <u>below.</u> ~~in the following text.~~

The evaluation/excitation electronics 2 ~~which are~~ identified by the reference number 2' <u>include</u> ~~have~~ three control loops: a first control loop for excitation and/or control of an antiphase oscillation of the first oscillators 3_1 and 3_2 along the common oscillation axis 72, a second control loop for resetting and compensation of the oscillations of the second oscillator 4_1 along the X2 direction, and a control loop for resetting and compensation of the oscillations of the second oscillator 4_2 along the X2 direction. The three described control loops <u>include</u> ~~have~~ an amplifier 60, an analog/digital converter 61, a signal separation module 62, a first to third demodulation module 63_1 to 63_3, a control module 64, an electrode voltage calculation module 65, a carrier frequency addition module 67, and a first to sixth digital/analog converter 66_1 to 66_6.

Carrier frequencies can be applied to the electrodes 8_1 to 8_8, 9_1 to 9_8, 10_1 to 10_8 and 11_1 to 11_4 for tapping excitation of the antiphase oscillation or of the oscillations of the second oscillators 4_1, 4_2. <u>This may be accomplished</u> in a number of ways. <u>They include</u> : a) using three different frequencies, with one frequency ~~being~~ associated with each control loop, b) using square-wave signals with a time-division multiplexing method, <u>and</u> ~~or~~ c) using random phase

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scrambling (stochastic modulation method).

The carrier frequencies are applied to the
electrodes 8_1 to 8_8, 9_1 to 9_8, 10_1 to 10_8 and 11_1 to 11_4
via the associated signals UyAo, UyAu (for the second
oscillator 4_1), ~~and~~ Uxl, Uxr (for the antiphase
resonance of the first oscillators 3_1 to 3_2) and ~~as well
as~~ UyBu and UyBo (for the second oscillator 4_2) that
~~which~~ are produced in the carrier frequency addition
module 67 and ~~are~~ excited in antiphase with respect to
the abovementioned frequency signals. The oscillations
of the first and second oscillators 3_1, 3_2, 4_1 and 4_2 are
tapped off via those parts of the gyro frame ~~which are~~
identified by the reference numbers 7_7, 7_9, 7_{11} and 7_{13},
~~and in this case are additionally~~ (used as tapping
electrodes in addition to their function as suspension
points for the mass system). For this ~~purpose,~~ the two
resonators 70_1, 70_2 are preferably ~~and advantageously~~
designed to be electrically conductive, with all of the
frames, springs and connections. The signal, ~~which is~~
tapped off by means of the gyro frame parts 7_7, 7_9, 7_{11}
and 7_{13} and ~~is~~ supplied to the amplifier 60, contains
information about all three oscillation modes. It ~~and~~ is
converted by the analog/digital converter 61 to a
digital signal ~~which is~~ supplied to the signal
separation module 62.

The assembled signal is separated into three
different signals in the signal separation module 62: x

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(which contains information about the antiphase

oscillation), yA (which contains information about the

deflection of the second oscillator 4_1) and ~~as well as~~

yB (which contains information about the deflection of

5   the second oscillator 4_2). The signals are separated

differently in accordance with ~~depending on~~ the type of

carrier frequency method used (see a) to c) above). ~~and~~

Separation is carried out by demodulation with the

corresponding signals of the carrier frequency method

10   ~~that is used~~. The signals x, yA and yB are supplied to

the demodulation modules 63_1 to 63_3 that ~~which~~ demodulate

them with ~~using~~ an operating frequency of the antiphase

oscillation for 0° and 90°. The control module 64 and ~~as~~

~~well as~~ the electrode voltage calculation module 65 for

15   regulation/calculation of the signals Fxl/r or Uxl/r,

respectively, are preferably configured analogously to

the electronics module 2 of ~~shown in~~ Figure 1. The

control module 64 and the electrode voltage calculation

module 65 (for regulation/calculation of the signals

20   FyAo/u, UyAo/u, and FyBo/u, UyBo/u) are preferably

designed analogously to the electronics module 2 of

~~shown in~~ Figure 2. ~~:~~ The only difference is that the

signals for ~~the~~ resetting ~~of~~ the rotation rate and ~~of~~

the quadrature after the multiplication by the operating

25   frequency are passed together with DC voltages for the

quadrature auxiliary regulator to a combined electrode

pair. The two signals are therefore added, so that ~~the~~

calculation of the electrode voltages includes the

resetting signals for ~~the~~ oscillation frequency and the

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DC signal for ~~the~~ quadrature regulation as well as ~~the~~ frequency tuning. The electrode voltages Uxl/r, UyAo/u and UyBo/u calculated in this way are then added to the carrier-frequency signals and ~~are~~ passed jointly via the analog/digital converters 66_1 to 66_6 to the electrodes.

Figure 4 <u>is a block diagram of an embodiment of a control system for incorporation into a mass system in accordance with Figure 3.</u> It shows one preferred embodiment of the control system ~~that is~~ identified by the reference number 64 in Figure 3. The control system 64 <u>includes</u> ~~has~~ a first to third part 64_1 to 64_3. The first part 64_1 has a first regulator 80, a frequency generator 81, a second regulator 82, an electronics component 83, an addition stage 84 and a multiplier 85. The ~~method of~~ operation of the first part corresponds essentially to <u>that</u> ~~the method of operation~~ of the electronics module 2 <u>of</u> ~~shown in~~ Figure 1 and will therefore not be described once again ~~here~~. The second part 64_2 has a first regulator 90, a first modulator 91, a second regulator 92, a second modulator 93 and a third regulator 94. A first and a second addition stage 95, 96 are also provided. A rotation rate signal Ω can be determined at the output of the first regulator 90, and an assembled signal comprising <u>the compensation of the</u> ~~a~~ quadrature bias B_Q and an acceleration A can be determined at the output of the third regulator 94.

The third part 64_3 of the control system 64

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has a first regulator 100, a first modulator 101, a

second regulator 102, a second modulator 103 and a third

regulator 104. A first and a second addition stage 105,

106 are also provided. A rotation rate signal Ω with ~~a~~

5   negative mathematical sign can be tapped off at the

output of the first regulator 100 and an assembled

signal comprising the <u>compensation of the</u> quadrature

bias B_Q with ~~a~~ negative mathematical sign and an

acceleration signal A can be tapped off at the output of

10   the third regulator 104. The method of operation of the

second and of the third <u>parts</u> ~~part~~ 64_2 and 64_3

corresponds to that of the electronics module 2

illustrated in Figure 2, and will therefore not be

explained ~~once~~ again ~~here~~.

15   Only the signals for resetting ~~of the~~ rotation

rate and ~~the~~ quadrature, after ~~the~~ multiplication by the

operating frequency, are passed, together with the DC

voltages for the quadrature auxiliary regulator, to a

combined electrode pair. The two signals are therefore

20   added so that the calculation of the electrode voltages

includes the reset signals for ~~the~~ oscillation frequency

and the DC signal for quadrature regulation. The

electrode voltages Uxl/r, UyAo/u and UyBo/u <u>thusly</u>

calculated ~~in this way~~ are then added to the carrier

25   frequency signals and ~~are~~ jointly passed via the

analog/digital converters 66_1 to 66_6 to the electrodes.

The carrier frequency methods described above

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with antiphase excitation have the advantage that a
signal is applied to the amplifier 60 only when the
linear oscillators 3_1, 3_2, as well as 4_1 and 4_2, are
deflected. The frequency signals ~~which are~~ used for
excitation may be discrete frequencies or square-wave
signals. Square-wave excitation is preferred, as it is
easier to produce and process.

Linear double oscillators are distinguished
by particularly high quality <u>due</u> ~~owing~~ to ~~the~~ linear
movement on the wafer plane. ~~The~~ Compensation for the
quadrature bias in ~~the case of~~ linear resonators in
which at least one oscillator is clamped in at one end
can be achieved, according to the invention, globally by
adjustment of the orthogonality of the springs. This is
achieved by varying the angle of the springs of the
oscillator, ~~which is~~ clamped in at one end, by means of
a DC voltage, such that the measured quadrature bias B_Q
becomes zero. As described above, a corresponding
control loop is used for this purpose <u>to regulate</u> ~~which
regulates~~ the abovementioned DC voltage <u>so</u> ~~such~~ that
$B_Q = 0$. <u>The</u> ~~This~~ control loop compensates for ~~the~~
quadrature bias at the point of origin and improves the
accuracy of linear oscillation gyros by a number of
orders of magnitude.

The linear oscillators of a resonator are
preferably each operated at double resonance.

While the invention has been described with reference to a presently-preferred embodiment, it is not limited thereto. Rather, this invention is limited only insofar as it is defined by the following set of patent claims and includes within its scope all equivalents thereof.

~~Patent Claims~~

1   1.   A method for quadrature-bias compensation in a

2   Coriolis gyro, whose resonator (1) is in the form of a

3   coupled system comprising a first and a second linear

4   oscillator (3, 4), having the following steps:

5   -   determination of the quadrature bias of the

6   Coriolis gyro,

7   -   production of an electrostatic field in order to

8   vary the mutual alignment of the two oscillators (3, 4)

9   with respect to one another, with the alignment/strength

10   of the electrostatic field being regulated such that the

11   determined quadrature bias is as small as possible.

1   2.   The method as claimed in claim 1, characterized in

2   that the electrostatic field results in a change in the

3   alignment of first spring elements (5_1 to 5_4), which

4   connect the first oscillator (3) to a gyro frame (7_3, 7_4)

5   of the Coriolis gyro, and/or a change in the alignment

6   of second spring elements (6_1, 6_2), which couple the

7   first oscillator (3) to the second oscillator (4).

1　3.　The method as claimed in claim 2, characterized in

2　that the alignment of the first spring elements

3　(5_1 to 5_4) is varied by varying the position/alignment of

4　the first oscillator (3) by means of the electrostatic

5　field, and in that the alignment of the second spring

6　elements (6_1, 6_2) is varied by varying the

7　position/alignment of the second oscillator (4) by means

8　of the electrostatic field.

1　4.　The method as claimed in claim 2 or 3,

2　characterized in that the electrical field results in

3　the alignments of the first and second spring elements

4　(6_1, 6_2, 5_1 to 5_4) being made orthogonal with respect to

5　one another.

1　5.　The method as claimed in one of claims 2 to 4,

2　characterized in that the second oscillator (4) is

3　attached to/clamped in on the first oscillator (3) at

4　one end by means of the second spring elements (6_1, 6_2),

5　and/or the first oscillator (3) is attached to/clamped

6　in on a gyro frame of the Coriolis gyro at one end by

7　means of the first spring elements (5_1 to 5_4),

6. A Coriolis gyro, whose resonator (1) is in the form of a coupled system comprising a first and a second linear oscillator (3, 4),

characterized by

- a device for production of an electrostatic field $(11_1', 11_2', 10_1$ to $10_4)$ by means of which the alignment of the two oscillators (3, 4) with respect to one another can be varied,

- a device (45, 47) for determination of any quadrature bias of the Coriolis gyro, and

- a control loop (55, 56, 57), by means of which the strength of the electrostatic field is regulated as a function of the determined quadrature bias such that the determined quadrature bias is as small as possible.

7. The Coriolis gyro as claimed in claim 6, characterized in that the first oscillator (3) is connected by means of first spring elements $(5_1$ to $5_4)$ to a gyro frame $(7_1, 7_2)$ of the Coriolis gyro, and the second oscillator (4) is connected by means of second spring elements $(6_1, 6_2)$ to the first oscillator (3).

8. The Coriolis gyro as claimed in claim 7, characterized in that the first and second spring elements are arranged/designed such that the alignment angle of the first spring elements (5_1 to 5_4) with respect to the gyro frame (7_3, 7_4) can be varied by means of the electrostatic field, and/or in that the alignment angle of the second spring elements (6_1, 6_2) with respect to the first oscillator (3) can be varied by means of the electrostatic field.

9. The Coriolis gyro as claimed in claim 7 or 8, characterized in that the second oscillator (4) is attached to/clamped in on the first oscillator (3) at one end by means of the second spring elements (6_1, 6_2), and/or the first oscillator (3) is attached to/clamped in on a gyro frame of the Coriolis gyro at one end by means of the first spring elements (5_1 to 5_4).

10. The Coriolis gyro as claimed in one of claims 7 to 9, characterized in that all of the second spring elements (6_1 to 6_2) which connect the second oscillator (4) to the first oscillator (3) are designed such that force is introduced from the first oscillator (3) to the second oscillator (4) essentially from one side of the first oscillator (3).

11. The Coriolis gyro as claimed in one of claims 7 to 10, characterized in that all of the first spring elements (5_1 to 5_4) which connect the first oscillator (3) to the gyro frame (7_3, 7_4) of the Coriolis gyro are arranged parallel and on the same plane as one another, with the start and end points of the first spring elements (5_1 to 5_4) each being located on a common axis.

12. A Coriolis gyro (1'), having a first and a second resonator (70_1, 70_2), which are each in the form of a coupled system comprising a first and a second linear oscillator (3_1, 3_2, 4_1, 4_2), with the first resonator (70_1) being mechanically/electrostatically connected/coupled to the second resonator (70_2) such that the two resonators can be caused to oscillate in antiphase with respect to one another along a common oscillation axis (72).

13. The Coriolis gyro (1') as claimed in claim 12, characterized by:
- a device for production of electrostatic fields (11_1, 11_2, 10_1 to 10_4, and 11_3, 11_4, 10_5 to 10_8), by means of which the alignment of the linear oscillators (3_1, 3_2, 4_1, 4_2) with respect to one another can be varied,
- a device for determination of the quadrature bias of the Coriolis gyro (1'), and
- control loops (64), by means of which the strengths of the electrostatic fields are regulated such that the determined quadrature bias is as small as possible.

1   14. The Coriolis gyro (1') as claimed in claim 12 or

2   13, characterized in that the configurations of the

3   first and of the second resonator (70_1, 70_2) are

4   identical, with the resonators (70_1, 70_2) being arranged

5   axially symmetrically with respect to one another, with

6   respect to an axis of symmetry (73) which is at right

7   angles to the common oscillation axis (72).

1   15. The Coriolis gyro (1') as claimed in one of claims

2   12 to 14, characterized in that the first oscillators

3   (3_1, 3_2) are each connected by means of first spring

4   elements (5_1 - 5_8) to a gyro frame (7_1 - 7_{14}) of the

5   Coriolis gyro, and the second oscillators (4_1, 4_2) are

6   each connected by means of second spring elements

7   (6_1 - 6_4) to one of the first oscillators (3_1, 3_2).

ABSTRACT

~~Method for quadrature-bias compensation in a Coriolis gyro, as well as a Coriolis gyro which is suitable for this purpose~~

~~In~~ A method for quadrature-bias compensation in a Coriolis gyro~~,~~ whose resonator ~~(1)~~ is in the form of a coupled system comprising a first and a second linear oscillator. ~~(3, 4),~~ The quadrature bias of the Coriolis gyro is determined. An electrostatic field is produced by variation of the mutual alignment of the two oscillators ~~(3, 4)~~ with respect to one another. ~~with~~ The alignment/strength of the electrostatic field <u>is</u> ~~being~~ regulated <u>so</u> ~~such~~ that the determined quadrature bias is <u>made</u> as small as possible.

~~(Figure 2)~~